Course Syllabus – MSNE 389/589 Ethics and Safety for Materials Engineers

Tuesdays: 4 PM - 4:50PM T SEW 309

Primary Instructor – Dr. Sergio Kapusta, Professor in the Practice

Office: Allen Center, Room B06 Office Hours: on request, typically 4-5 pm daily

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Course Description:

Ethics and Safety for Materials Engineers is a new one-credit course that will provide students the tools, knowledge and practice to identify and resolve engineering ethics challenges. Contemporary issues in engineering ethics will be presented through case studies current news, and also through experiences with ethical challenges in engineering. These issues include research integrity, professional ethics, safety in the lab and in your profession, intellectual property right and engineering ethics and sustainability.

Teaching approach:

Engineering ethics is not a theoretical study. It is about the application of ethical thinking to practical situations that develop in engineering, particularly related to personal and process safety. In this course we will explore cases that highlight specific ethical issues and discuss the ways to resolve those issues. Class participation is integral to the learning experience. Class questions and assignments will provide practice with ethical decision- making, and practical experience and resources to improve ethical decision-making.

Student outcome:

To address ABET student outcomes and program criteria, the students will have
(a) An ability to apply knowledge of natural science, social sciences, and engineering to identify solutions to ethical challenges and dilemmas.
(b) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(c) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

Specific student outcomes include:

1. Students in this course will gain a robust understanding of the meaning of ethics in the engineering profession, and how it affects their professional life.
2. Students will learn about relevant moral and ethical theories, professional codes of ethics, the common morality, intellectual property rights, conflicts of interest, and fairness in information.
3. Students will be able to recognize ethical and professional responsibilities and make informed choices about them.
4. Students will be able to recognize and address issues related to health and safety of employees, colleagues, and the public.
5. Students will gain confidence in intervening to address ethical and safety situations that might arise in their professional life.

Graded student materials, such as assignments, discussions, and quizzes will demonstrate completion of the above requirements.

Disability Support: Any student with a disability requiring accommodations in this class needs to contact both the instructor and the Disability Resource Center in Allen Center.

Academic Integrity: The Rice University Honor Code will apply to all class assignments and exercises.

Absence Policy: Students are expected to attend class and actively participate to the maximum extent permitted by their own health and by the campus crisis committee. Class attendance is required and expected. Absences will be evaluated on individual cases.

Course Readings – All readings will be posted in the course Folder. No textbooks are required for purchase.

Course Grading - Grading is based on class attendance and participation (50%) and five assignments (10% each = 50%)

Class Schedule – The following schedule is tentative. The exact weekly program will be provided one week in advance through the class folder.

Module One – **Tuesday January 11, January 18, 2022 "Overview of Ethics and Engineering Ethics**" **(2 hours**)

This first module introduces students to meaning of ethics and the need for ethical reasoning in engineering.

Readings Required:

File - Introduction (on-line),

Powerpoints: Overview of Ethics, Engineering Ethics, and Ethical Theories Folder

Journal Articles:

(1) Lang, Erin R ., S.M.ASCE "Applying Ethics to Engineers". Journal of Professional Issues in Engineering Education and Practice, ASCE/ July 2003, pp: 134-135
(2) **Read for Assignment**: Richard A. Burgess • Michael Davis • Marilyn A. Dyrud • Joseph R. Herkert • Rachelle D. Hollander • Lisa Newton • Michael S. Pritchard • P. Aarne Vesilind" Engineering Ethics: Looking Back and Looking Forward" Sci Eng Ethics (2013) 19:1395–1404
(3) **"What were they thinking", VW Dieselgate**

Module Two – January 25, February 1, 2022. "Professional and Research Integrity" (2.5 hours)

Issues in research integrity cover scientific misconduct: falsification of data, fabrication of data, plagiarism, unethical treatment of research subjects, and failure to disclose conflicts of interest. In engineering ethics, professional ethics will cover issues fraud, corruption, mismanagement, poor product design, deliberate design faults or and harms from engineering projects/products.

Readings Required:

File - Module Two Instructions/Lecture Notes (on-line),

Powerpoint – Research Integrity and Professional Integrity for Engineers

Journal Articles:

(1) Harris, Charles E. The Good Engineer: Giving Virtue its Due in Engineering Ethics. Sci Eng Ethics (2008) 14:153–164
(2) Sovacool, Benjamin .Exploring Scientific Misconduct: Isolated Individuals, Impure Institutions, or an Inevitable Idiom of Modern Science? Bioethical Inquiry (2008) 5:271–282
(3) Parrish, Debra M. Scientific Misconduct and Findings Against Graduate and Medical Students. *Science and Engineering Ethics* (2004) **10**, 483-491
(4) Genetically engineered babies – when research exceeds the limits of ethical behavior.

Module Three – Tuesday, February 8 and 15, 2022. Personal and Process Safety – your responsibility

This module covers ethical, moral, legal and economic basis of safety, more specifically your own personal and professional responsibility for ensuring a safe working environment. We will also look at the tools and work processes which help maintain safety, such as HAZOP, Process Hazard Analysis, check list, etc.

Readings Required :

File - Module Three Instructions/Lecture Notes (in class and on-line),

Powerpoint – "NEEP Code of Conduct for Engineers"

Articles:
(1) Lessons from Longford -

http://docshare01.docshare.tips/files/8412/84122979.pdf

(2) Bhopal – a systemic failure https://www.nytimes.com/1985/02/03/world/the-disaster-in-bhopal-lessons-for-the-future.html

(3) Boston tunnel collapse:

https://en.wikipedia.org/wiki/Big_Dig_ceiling_collapse ;

Tunnel of Terror, NASA case study: https://sma.nasa.gov/docs/default-source/safety-messages/safetymessage-2008-06-01-thebigdigceilingtilecollapse.pdf?sfvrsn=e3a91ef8_4

Module Four –Feb 22, March 1, 2022 -Your engineering responsibility

In this module, we will discuss in more detail a specific case of engineering ethics which covers topics such as environmental responsibility, whistleblowing, data integrity, public response and acting within the limits of your expertise .

File - Module Four Instructions/Lecture Notes (in class and on-line),

Powerpoint – Powerpoint " Gilbane Gold case study"

Readings

Watch the video “Gilbane Gold” (30 minutes). It will be uploaded to the course website. Prepare to discuss the issues in class – assignment will be graded based on class participation

Journal Articles:

Materials engineering and safety

Module Five – Sustainability and Engineering Ethics –March 8 and 22, 2022

This module will cover an overview of sustainability, current topics in engineering ethics regarding sustainability – i.e. adaptive design, green technologies, renewable energy technologies, and other appropriate topics in sustainability planning (economics, environment and equity). Environmental justice and community-based management topics in engineering and sustainability also will be reviewed.

File - Module Five Instructions/Lecture Notes (in class and on-line),

Powerpoint Reading – Powerpoints "Global Efforts for Sustainable Development" and "Mainstream Sustainable Development" Also: "CBPR and Environmental Justice", "Cultural Competence"

Journal Articles:

MRS Online Proceedings Library (OPL) , Volume 1532: Symposium ZZ – Communicating Social Relevancy in Materials Science and Engineering Education , 2013 , mrsf12-1532-zz01-05

DOI: https://doi.org/10.1557/opl.2013.428

Module Six – Materials Engineering, materials selection, ethical and safety issues –March 29, April 5, 2022

Materials selection and safety: https://www.researchgate.net/publication/223184431_Material_selection_and_product_safety_Theory_versus_practice

Materials selection: cost and performance